Alberta
DEPARTMENT OF HOUSING

Innovative Housing Grants Program

INNOVATIVE USE OF ON-SITE PRECAST STRUCTURES FOR LOW AND MID RISE HOUSING

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Introduction

This project commenced by evaluating the feasibility of a large number of different on-site precast concrete construction systems for low and mid-rise housing in Alberta. Two systems, the Ucopan System and the Fulcrum Tilt System, showed particular promise and therefore were examined in detail based on the following criteria:

- economic feasibility;
- degree of sophistication of construction techniques;
- initial capital requirements;
- price variation of major cost elements;
- manpower requirements;
- flexibility of design;
- thermal and acoustic characteristics;
- appropriateness in terms of unit livability and aesthetics;
- speed of construction and susceptibility to weather conditions; and
- life cycle cost.

UCOPAN System

This system involves casting of relatively small elements on site, then hoisting these elements into place and welding the individual elements together to form an extremely rigid structure. With this system, buildings may have a modular character due to the standardization of the system. Site limitations will only marginally limit the application of the system. Structually the UCOPAN system presents no unusual engineering problems.

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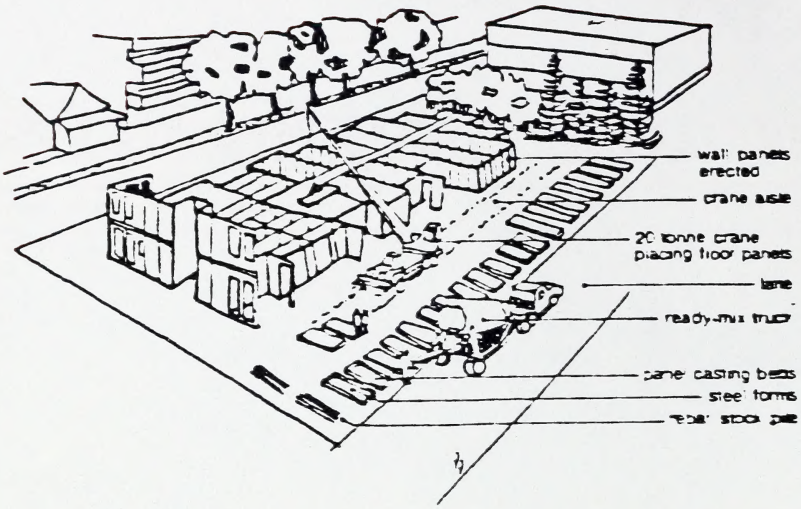

Figure 1. Ucopan System

FULCRUM-TILT System

This system involves building a cellular ("egg crate") unit horizontally on site, pouring the concrete, and then tilting the unit to a vertical position, to form the basic structural elements of a mid-rise apartment building. A precast plank is then dropped in between the "egg crate" units and stair and elevator elements.

Buildings using this system do not look much different from poured-in-place structures as identical exterior finishes can be used. The structural analysis should be carried out by an engineer familiar with tilt-up systems. Sites may limit the overall height of the structures due to the space required to pour the frames. For buildings up to six storeys this should not pose much of a problem.

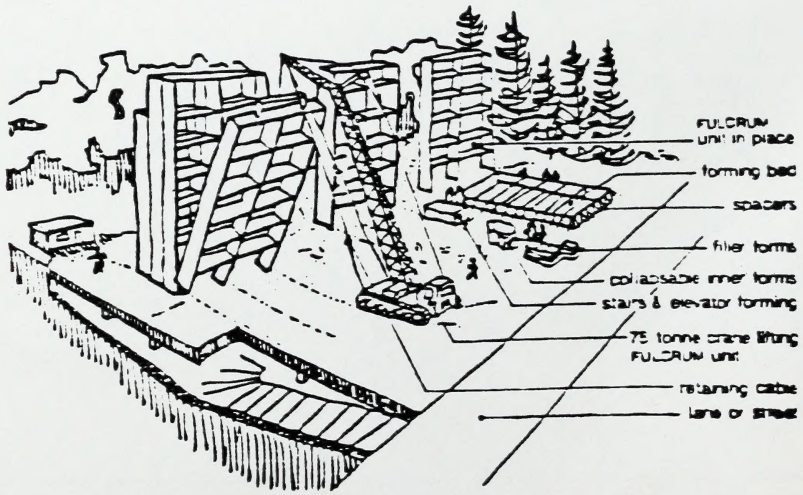

Figure 2. Fulcrum Tilt System

Conclusions

The architectural, structural and, to a lesser degree, the cost evaluations indicate that both building systems are feasible from the point of view of providing pleasant, functional living units, and can meet all accepted structural engineering standards. The construction techniques required are practical and do not require the development of any new technology.

The cost analysis of the FULCRUM TILT System indicates that there is a potential saving in the structural elements of approximately ten percent compared to cast-in-place concrete.

Cost analysis of the UCOPAN System indicates that with Alberta's current material and labour costs, the system does appear feasible compared to cast-in-place concrete, but it is more expensive than wood-frame construction. UCOPAN system costs will become feasible if lumber costs become significantly higher than concrete costs.

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ECOSTUD BUILDING SYSTEM

David F.Begin, P. Eng.

Introduction

The concept of the Ecostud Building System was developed to allow for increased insulation levels required to provide more energy efficient housing. It is an alternative to double stud walls and other framing systems. The Ecostud is almost as simple as conventional stick framing while providing insulation levels similar to double stud walls.

System Concept

The Ecostud is in essence very similar to a roof truss. The stud is constructed from two vertical wood members separated by 38 x 89 mm. spacers. The load bearing member, (referred to as the major stud) has minimum dimensions of 38 x 65 mm; and the other stud, referred to as the minor stud, has minimum dimensions of 38 x 65 mm. The major and minor stud and wood spacers are tied together with 38 x 75 mm truss plates.

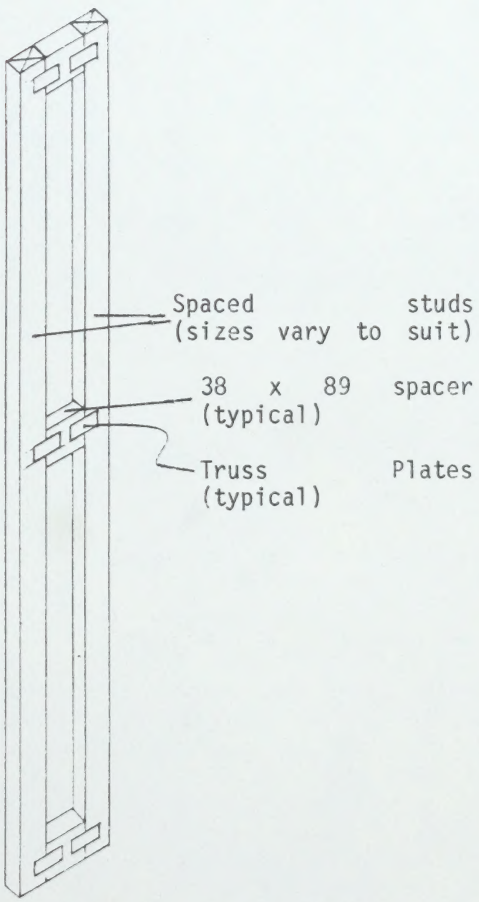

Figure 1. Ecostud Building System

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Structural Design

Preliminary structural analysis indicates that the load-bearing capacity of the Ecostud constructed out of the 38 x 65 mm major stud and the 38 x 65 minor stud may be equivalent to the standard 38 x 89 mm stud. The Ecostud has the potential to handle increased structural loads when the sizes of the major and minor stud are increased, but this will be the subject of further research and actual testing.

Framing Details

Framing details were developed for a house using the Ecostud Building System, to demonstrate and test the application of the Ecostud. The demonstration project confirmed that this system is a fast and efficient method of incorporating more insulation into wood frame walls. Additional benefits of this system are relatively easy vapour barrier details and reduced labour cost for electrical wiring as fewer holes have to be drilled.

Cost Comparison

Preliminary cost evaluations of nine different wall-framing systems indicate that the Ecostud is one of the most cost effective systems.

Conclusions

The analysis and research carried out so far indicate that the Ecostud is a viable construction method for framing wide walls to allow for increased insulation levels. More rigorous structural analysis and testing will be carried out to obtain regulatory approvals for the framing system.

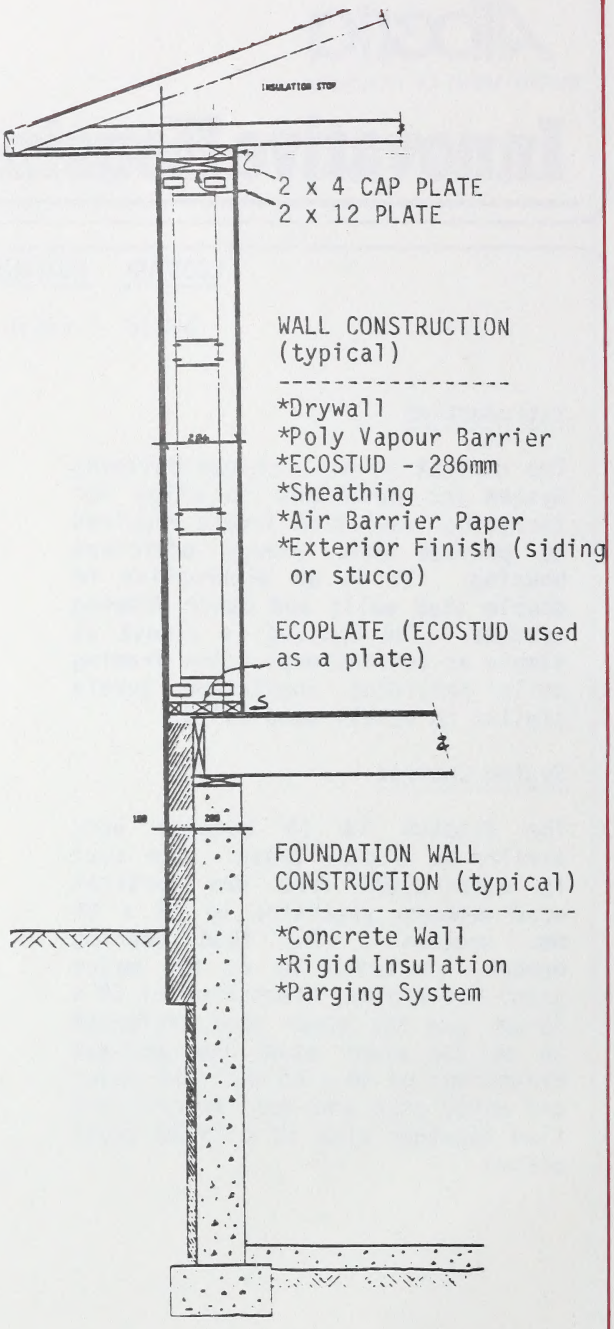

Figure 2. Ecostud Building System (typical)